$$\frac{22}{365} \approx \frac{20}{360} = \frac{2}{36} = \frac{1}{13} \; ?$$

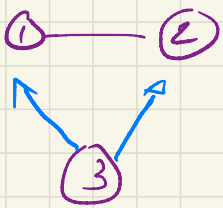
$\sim 50\%$

Birthday Paradox

Does not show a birthday

$\bar{P}(1) = 1$

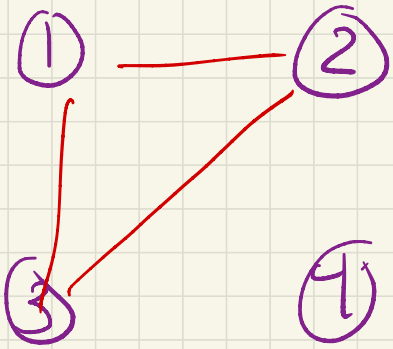
$\bar{P}(2) = \frac{364}{365}$



$\bar{P}(3) = \frac{363}{365} \cdot \bar{P}(2)$

$\frac{365}{365} \cdot \frac{364}{365}$

$\bar{P}(3)$



$\bar{P}(4) = \frac{362}{365} \cdot \bar{P}(3) = \frac{362}{365} \cdot \frac{363}{365} \cdot \frac{364}{365} \cdot \frac{365}{365}$

$\bar{P}(3)$

$\bar{P}(1)$

$\bar{P}(2)$

$\bar{P}(4)$

$$\bar{P}(4) = \frac{P(365,4)}{365^4}$$

$P(365,4)$ ← choos 4-birthdays wro repitition

365^4 ← choose 4-birthdays w/repitition

$$P(365,4) = \frac{365 \cdot 364 \cdot 363 \cdot 362 \cdot \cancel{\cdots} \cdot \cancel{2} \cdot 1}{361!}$$

$$\bar{P}(22) = \frac{P(365,22)}{365^{22}}$$

$$P(22) = 1 - \frac{P(365,22)}{365^{22}}$$

$$1 - 0.526$$

$$= \boxed{47.4\%}$$

probability at least 2 people share birthdays out of 22!

1 — 10

① if we draw two number what is the prob. that the two are the same?

① ← ② = $\frac{1}{10} \in P(2)$

$\bar{P}(2) = \frac{9}{10}$ $P(\cdot) + \bar{P}(\cdot) = 100\%$

② 5 numbers are drawn...

$\bar{P}(5) = \frac{6}{10} \cdot \bar{P}(4)$ & $\bar{P}(2)$

$= \frac{6}{10} \cdot \frac{5}{10} \cdot \bar{P}(3) \cdots$

0000

000000

6/10

$\bar{P}(4)$

$\bar{P}(5) = \frac{6}{10} \cdot \frac{7}{10} \cdot \frac{8}{10} \cdot \frac{9}{10} \cdot \frac{10}{10} = \frac{P(10,5)}{10^5}$

P(3)

P(2)

30,240

30,240 / 100,000

30.24%

$$\bar{P}(5) = \frac{6}{10} \cdot \bar{P}(4)$$

$$\bar{P}(4) = \frac{7}{10} \cdot \bar{P}(3)$$

$$\bar{P}(3) = \frac{8}{10} \cdot \bar{P}(2)$$

$$\bar{P}(2) = \frac{9}{10} \cdot \bar{P}(1)$$

$$\bar{P}(1) = \frac{10}{10}$$

$$\bar{P}(5) = \frac{6}{10} \cdot \frac{7}{10} \cdot \frac{8}{10} \cdot \frac{9}{10} \cdot \frac{10}{10}$$

$$= \frac{P(6,10)}{10^5} = 0.3024$$

30.24%

$$P(5) = 1 - 0.3024 = \boxed{69.76\%}$$